

The Relationship between Consumer Price Index and Producer Price Index with stock return

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Abstract

Stock return is one of the main indexes for evaluating managers' performance. This index is influenced by different factors such as price index, especially consumer price index and producer price index. The relationship between stock returns and inflation indicators have been considered more but so far, no clear relationship was found in distinctive studies. This relationship due to different rates of inflation indexes is varied from country to country, and Different economic structure provides distinct results. In this paper, we use a new method to study of relationship between Consumer Price Index (CPI) and Producer Price Index (PPI) with stock return in companies listed in Tehran Stock Exchange. A sample of 132 companies, members of Tehran Stock Exchange, was selected for a 10-year period (2002-2010). The study showed that CPI and PPI seem appropriate to explain stock returns and there a direct (positive) relationship between stock return with Consumer Price Index, and indirect(negative) with Producer Price Index.

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Keywords: stock return, consumer price index, producer price index, Granger-causality test, finance

1- INTRODUCTION

Founding of a stock exchange in every country indicates beginning of a stage of economy development and growth stages, thus. Stock exchange would not be set up as long as there is no need for capital accumulation necessity and its gathering for the monetary plan of state economical development projects, or if it's established it wouldn't play any substantial role in an economy. Currently, stock exchange is considered as one component in public economy components in most developed and developing countries and financial capital of the society are collected by it, and it is used for achievement of economical development goals.

The largest part economists claim that firm executives in a stock exchange should have a criterion derived on which they evaluate their performance. In addition, they need criterion for calculating various economic plans. Determining and establishing the most suitable criterion for performance evaluation for everyone or every organizational part in firms with different actions is a function of two factors: principal strategy of firm and actions carried out by individuals in these units toward the first strategy realization.

A kind of common performance evaluation criteria is accounting for criteria of performance evaluation (including rate of return, return on equity, dividend per share, stock returns) . In fact, these criteria are among the main indices for evaluating performance of managers and used by stock holders for investigating level of firms. The Stock return is one of the most important criteria for performance evaluation that it is widely used in Tehran Stock Exchange market.

One of the factors impacting on stock return are price indices such as consumer price index (CPI) and producer price index (PPI). CPI or goods and service price index is one of the most important price indices for assessing inflation rate and purchasing power of domestic currency. It measures changes in products and service prices bought by households or customers.

Producer price index (PPI) defines price change received monthly by producer for its producers. It is highly associated with the market, and it is closely considered as an index of present inflation level. These indices frequently are followed narrowly since investors search for inflation pressure signs, which may change an interest rate (Bittencourt, 2010).

In this study, we investigate the relationship between consumer price index and producer price index with Stock return of listed firms in Tehran Stock Exchange during 2002-2010.

2- Review of Literature

Diaz (2009) calculated relationship between inflation (CPI) and stock return and dividend per share in Spain. He found that the impression of inflation on stock return and dividend per share depends on potential intermediate factors such as risk-free interest rate, future growth assumptions and risk premiums. He also found that there is important positive association between inflation and stock return and dividend per share when there is bad news (actual inflation rate is higher than expected rates of inflation) and there is an indirect relationship when there is good news (actual inflation rate is lower than expected rates of inflation) (Diaz, 2009).

Sharma (2011) looked into an effect of movements of Board of Directors and general economic environment on the amount of profit per share using data from 944 public firms in 2006. He found the out movement of Board of Directors to increase or fix profit per share decreases by the increase in CPI (inflation) thus return per share reduces, that is, CPI (inflation) is oppositely proportionate with profit per share (Sharma, 2011).

Walter Lane (2006) compared USA and Europe inflation about CPI. He instituted an empirical CPI for USA, which was matched with European CPI. America CPI is different from Europe's in two respects. One is rustic population, and the other is being housed holder. He showed that CPI has lower inflation effect in USA compared to Europe as well as the lower effect on America's firms' profitability compared to European (Lane, 2006).

Williams (2008) suggested a model for examining the impact of access to internet service on CPI. This model directly investigated internet service price impact on CPI and following Inflation. Finally, they ended that internet service access has the positive impact on CPI (Williams, 2008).

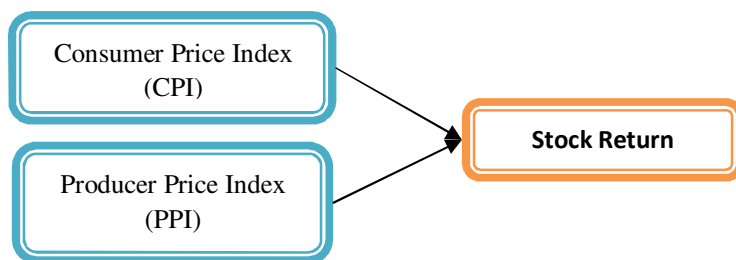
One of the factors obtaining from CPI and PPI is inflation. In many studies, the effect of inflation (with basis of CPI and PPI) on financial performance indexes such as stock return and dividend per share has been investigated. For example, findings of experimental study by Graham (1996) suggested that relationship between stock return and inflation is instable; that is, it is a positive relationship in some periods, and it is negative in other ones. Results for study by Jung (1997) demonstrated that predicted inflation have negative effect on share's prices, which leads to a reduction in dividend per share (Graham, 1996).

3- Research Hypotheses

There is a relationship between consumer price index (CPI) and stock return.

There is a relationship between producer price index (PPI) and stock return

1-3- Conceptual Model



2-3- Statistical Population and Sampling

The statistical population for this study includes firms accepted in Tehran Stock Exchange with following conditions:

- All firms should be in the stock exchange from beginning of the year 2002 until end of the year 2010
- Their information should be fully accessible
- Insurance, banks and investment firms are eliminated.

Considering above-mentioned conditions, 200 firms were included in the statistical population. In determining sample size, P or success ratio in population was considered as 0.50 so that it is insured that highest size is calculated, thus sample size with supposed limited statistical population was calculated using sampling formulae in confidence level 0.95.

$$n = \frac{N(Z_{\alpha/2})^2 \cdot pq}{(N-1)d^2 + (Z_{\alpha/2})^2 \cdot pq}, \quad n = \frac{200 \times (1.96)^2 \times 0.5 \times 0.5}{(199) \times (0.05)^2 + (1.96)^2 \times 0.5 \times 0.5} = 132$$

3-3- Source of Data

For this study, we collected data from the Central Bank of Iran and the Tehran Stock Exchange. We use the electronic archival data provided by TSE. In some cases that, the essential data is incomplete we use the manual

archive existed in the TSE's library. We also, acquire a part of wanted data from Tadbirpardaz and Sahra (two Iranian Software's).

4-3- Methodology

In this study, first reliability or irresponsibility of time series is investigated using unit root test. To this end, Augmented Dicky- Fuller test is used. Then, since it's possible that there is serial correlation in time series, Phillips-Perron test is used. Pearson's correlation is used for surfing the relationship between two variables and Granger's causality test is used for investigating variable's impact and influence time.

4- Variables

1-4- Dependent Variables

1-1-4-Stock Return

Currently, the main criterion for performance estimation is usually stock return rate. It includes information for investors and is used for evaluating performance. When it is decreased, it means a warn for the firm and show inappropriate performance for the firm. This criterion contains much information because it reflects performance evaluation based on market value and investor's information. Return is a dynamic in investors' process, which generates motivation and is considered as a reward for investors. Total return means profits belonging to the share over the whole year.

The formula for the total stock return is the appreciation in the price plus any dividends paid, divided by the original price of the stock. The income sources from a stock are dividends and its increase in value. The first portion of the numerator of the total stock return formula looks at how much the value has increased ($P_1 - P_0$). The denominator of the formula to compute a stock's total return is the primary price of the stock which is used due to being the first amount invested..

$$R = \frac{(P_{t+1} + P_t) + D}{P_t}$$

R = stock return, P_{t+1} = stock price by the end of month, P_t = stock price in the beginning of the month, D = dividend or other takes.

Thus, stock return during a given period can be extracted just using stock value in beginning and end of the period.

2-1-4-Consumer Price Index (CPI)

A consumer price index (CPI) measures changes in the price level of consumer goods and services purchased by households. The CPI is defined by the Bureau of Labor Statistics as "a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services." CPI is defined by United States Department of Labor Statistics as follows: CPI is the measurement of average price change in price paid by customers over time for products and services provided for them (Abel, 2005). Two basic types of data are required to construct the CPI: price data and weighting data. The price data are composed for a sample of goods and services from a sample of sales outlets in a sample of places for a sample of times. The weighting data are estimates of the shares of the different types of expenditure in the total expenditure covered by the index. These weights are usually based upon expenditure data obtained from expenditure surveys for a sample of households or upon estimates of the composition of consumption expenditure in the National Income and Product Accounts. Although some of the sampling of items for price collection is done using a sampling frame and probabilistic sampling methods, many items and outlets are chosen in a commonsensible way (purposive sampling) that does not permit estimation of confidence intervals. Hence, the sampling variance cannot be calculated. In any case, a single estimate is needed in most of the purposes for which the index is used. In order to select products and services, which are the bases for measurement, first importance factor of products and services are calculated using results of household budget investigation. Then, considering the weight and their pricing capability they are put in the calculation portfolio. Product and service price index has three exclusive groups and eight main groups.

CPI can be used as an index (regulatory index of inflation effect, for example) of the actual value of benefits, salary, and pension, to set prices and to reduce the amount of money for representing that these changes have actual values (Blanchard, 2000).

Goods portfolio change price of which is considered in this index include consuming goods, which are important for urban households. Importance factor estimation for each good in household consumption portfolio and goods' average prices are critical in accurateness of index calculation since they are the calculation basis. Importance factor or weight of goods is came by from household budget investigation. Basis for these factors are updated annually, but relative price calculation for a good or service is what should be settled regarding each goods and is calculated through arithmetic mean or geometric mean. Difference between these means may be insignificant in each goods (product or service), however, in the whole goods sum of these distinctions provide considerable difference (Castelnuovo, 2010).

The index is usually computed monthly, or quarterly in some countries, as a weighted average of sub-indices for different components of consumer expenditure, such as food, housing, clothing, each of which is in turn a weighted average of sub-sub-indices.¹

Generally below relationship is used for index calculation:

$$\text{CPI} = \frac{\text{day price}}{\text{basic price}} * 100$$

2-4-Independent Variables

1-2-4-Producer Price Index (PPI)

A Producer Price Index (PPI) measures average changes in prices received by domestic producers for their output. It is one of the several price indices. Its importance is being mined by the steady decline in manufactured goods as a share of spending (Economist, 2008).

Producer price index defines price change received monthly by producer for its producers. Data are determined using polls in various sectors, including production, agriculture, mining and urban service. In the US, the PPI was known as the Wholesale Price Index, or WPI, up to 1978. The PPI is one of the oldest continuous systems of statistical data produced by the Bureau of Labor Statistics, as well as one of the oldest economic time series composed by the Federal Governmentⁱⁱ.

The origins of the index can be found in an 1891 U.S. Senate resolution authorizing the Senate Committee on Finance to examine the effects of the tariff laws "upon the imports and exports, the growth, development, production, and prices of agricultural and manufactured articles at home and abroad"ⁱⁱⁱ

Producer price index is highly related with the market, and it is closely deliberated as an index of current inflation level. Like other price indices, increase in its value may show an increase in an interest rate which is considered for the inflation fight (Blanchard, 2000).

In addition, it should be celebrated that PPI report is the first report of inflation measurement obtainable monthly. Thus, it is followed narrowly since investors seek for inflation pressure signs, which may change the interest rate (Huang & Lin, 2010).

Producer price index is generally published before consumer price index and pulls close attention since observers use PPI as part of CPI valuation. PPI report has the average impact on the market (Economist, 2008). If investors appear that PPI values (without the concern of immediate rising interest rates) are signs of robust economy, then they expect increased activity in the stock exchange.

5- Testing Hypotheses

1-5-Time Series Reliability

Since the study is of time series type, and it is extracted from time-series data and because ordinary least square's method was used for estimation in hypotheses and prerequisite for using the linear regression model in ordinary least squares, method is reliability of pattern variables, it is necessary to perform reliability and unreliability test for research variables. To this end, augmented Dickey-Fuller test (ADF) was used. The optimal intervals for Dicky Fuller test were specified using Schwarz Info Criterion, so that the interval with highest Schwarz value would be the best one (Ghysels et al., 2001).

H_0 and H_1 hypotheses are as follows:

H_0 : respective variable has the unit roots.

H_1 : respective variable doesn't have unit root (statement of a stasis conditions for the variable)

Results for Dicky Fuller test at variable's level are given in table 1. Regarding Prob value for all variables, H_0 is supported, that is, these variables have unit root, and thus they are not static. Variables should be stabilized by higher-order differential. Therefore, Dicky Fuller test was applied for a difference of first order of model variables. Augmented Dicky Fuller test results for first-order differential of variables are given in table 2.

regarding ADF test results on first-order difference of model variables' values, H_0 is rejected and H_1 is accepted implying model variables are static. All variables follow the inert process in difference and are first-order inert. Thus, all variables of the model became inert by once difference. According to econometric concepts, existence of serial correlation leads to incorrect estimations of the standard error and thus, wrong incorrect statistical inference for equation factors. Since serial correlation is probable in these time series, Phillips-Perron test is used. It is used for determining a statistic condition of a time series when serial correlation is probable in time series. Hence two hypotheses are introduced:

H_0 : variable has the unit roots (it is not static)

H_1 : variable doesn't have root unit (it is static)

Results for Phillips-Perron tests at variable's level are given in table 3.

Regarding Prob value for all variables, H_0 is supported, that is, these variables have unit root, and thus they are not static. Variables should be stabilized by higher-order differential. Therefore, Phillips-Perron test was applied for a difference of first order of model variables. Phillips-Perron test results for first-order differential of variables are given in table 4. regarding Phillips-Perron test results from it is shown that H_0 is rejected and H_1 is supported implying that model variables are static.

2-5- Testing Hypotheses

Correlation is a statistical tool to determine the type and degree of correlation between a quantitative variable with another one. Correlation coefficient is one of the criteria used in determining correlation between two variables. Correlation coefficient shows severity and direction (direct or inverse) relationship. In this study, Pearson's correlation coefficient is used regarding the data type. This coefficient calculates the correlation between two interval or relative variables. Results for investigation of relationship between variables are given in table 5.

Considering at table 5, it is concluded that stock return ($R = -0.37$) and has indirect relationship with CPI. In addition, stock return ($R = 0.41$) has significant direct relationship with PPI. Then Granger's causality test is used for investigating variable's influence and influence time.

Granger's test defines X causality in Y regarding Y predictability, and Y will be caused of the X if prior values of the Y decrease X predictability error (Ghysels et al., 2001). In this study, Granger's causality test was used following finding correlation between variables in order to examine their influence and delay period. Results of Granger's causality test are summarized in table 6.

Regarding results, it is clear that CPI influences on stock return, however, this effect happens with one year of delay. That is, CPI influences on stock return in future year, and it doesn't influence on them in current year, and it was influenced by last year CPI. PPI influences on stock return, but, this effect happens with one year of delay.

6- Conclusion and Suggestions

Relationship between stock return and CPI was studied in first hypothesis. It was found there is inverse relationship between CPI and stock return. Regarding findings, since CPI influences with one-year delay, shareholders can forecast the effect of current-year CPI (inflation) on the next year stock return. Administrators can increase dividend per share and reduce retained income in order to decline the influence of CPI on their stock return so that they adjust this effect and remove return decrease news, which is a bad news for the firm. Some previous studies found inverse relationship between stock return and CPI (inflation), and some didn't find any fixed relationship between them. Relationship between stock return with PPI was surfed in second hypotheses. Unlike our expectation, there was a positive relationship. One cause for it is an increase in good price higher than the increase in PPI. That is, increase in raw material price increases PPI and the firm has to increase its product price, but this price increase is more than the increase in raw material price so that firm profitability is increased.

Simultaneously, it might sell (demand) is decreased but this decrease is lower than a price increase. When there is an increase in PPI, it is proposed that retained earnings, and it is spent on raw material purchase and increased activity. Increased activities in the current year may reduce operational profit but stock return is increased in the next year due to increased operational profit.

In our study, it was found that CPI has inverse relationship, and PPI has direct relationship with stock return. It was deduced that these indices influence on financial performance. Results of this study are in consistency with previous works such as Diaz (2009), Sharma (2011), Glatkin (1983), and Badukh and Richardson (1993) and are not consistent with findings of some studies such as Graham (1996), and Jung (1997), which showed no relationship between inflation and financial performance, especially stock return.

Recommendations for Future Works

- Surfing the effect of inflation indexes on firms' profitability and stock return in different industries
- Surfing other inflation indexes such as wholesale price, export price index and, etc. on stock return
- Surfing the long-term relationship among CPI and PPI and stock return and other financial ratio's income

reference

- Ghysels E, Osborn D. 2001. *The Econometric Analysis of Seasonal Time Series*. Cambridge University Press

- Abel A.2005. Macroeconomics (5th ed)
- Díaz A.2009. Explanatory factors of the inflation news impact on stock. *Research in International Business and Finance* 23 † 349–.368
- Williams.B 2008. a hedonic model for Internet access service in the Consumer Price Index
- Castelnovo.E 2010. Tracking U.S. inflation expectations with domestic and global indicators. *Journal of International Money and Finance* 1340-1356
- Graham.F 1996. Inflation Real Stock Returns and Monetary Policy. *Applied Financial Economics* .
- Huang H and Lin.S 2010. Inflation and the finance–growth nexus. *Economic Modelling* †229–236.
- Bittencourt.M 2010. Inflation and financial development: Evidence from Brazil. *Economic Modelling* †0-9
- Blanchard.O 2000. *Macroeconomics* (2nd ed).Prentice Hall: Englewood Cliffs, N.J.
- Sharma V. 2011. Independent directors and the propensity to pay dividends. *Journal of Corporate Finance* 17 † 1001–1015.
- The Economist. 2008. Volume 387, May 31 - June 6 2008, page 109.
- Lane.W 2006. Comparing U.S. and European inflation: the CPI and the HICP. *Monthly Labor Review* †20-27.
- www.wikipedia.org

Notes

ⁱ [Wikipedia.org](http://www.wikipedia.org)

ⁱⁱ BLS Handbook of Methods, Chapter 14 Producer Prices, Background (found online at: http://www.bls.gov/opub/hom/homch14_a.htm)

ⁱⁱⁱ <http://www.bls.gov/ppi/ppicippi.htm>

Tables

Table 1. Dicky Fuller test results for pattern variables

Variables	The number of appropriate intervals	Intercept	Trend	Augmented Dickey-Fuller test statistic	MacKinnon critical values			Prob
					1%	5%	10%	
CPI	Level	+	+	1.395	-3.61	-2.94	-2.609	0.998
PPI	Level	+	+	1.907	-3.62	-2.94	-2.619	0.999
Stock Return	Level	+	+	-1.5479	-3.61	-2.93	-2.601	0.499

Table 2. Dicky Fuller test results for first order difference of variables

Variables	The number of appropriate intervals	Intercept	Trend	Augmented Dickey-Fuller test statistic	MacKinnon critical values			Prob
					1%	5%	10%	
CPI	1	+	+	-3.096	-3.615	-2.941	-2.609	0.035
PPI	1	+	+	-3.036	-3.631	-2.943	-2.610	0.004
Stock Return	1	+	+	-6.605	-3.615	-2.941	-2.609	0.000

Table 3. Phillips-Perron test results

Variables	The number of appropriate intervals	Intercept	Trend	Phillips-Perron test statistic	Test critical values			Prob
					1%	5%	10%	

CPI	Level	+	+	5.64	- 4.58	- 3.32	-2.80	1.000
PPI	Level	+	+	4.01	- 4.58	- 3.32	-2.80	1.000
Stock Return	Level	+	+	-1.34	- 4.58	- 3.32	-2.80	0.55

Table 4. Phillips-Perron test results with once difference

Variables	The number of appropriate intervals	Intercept	Trend	Phillips-Perron test statistic	Test critical values			Prob
					1%	5%	10%	
CPI	1	+	+	-1.43	- 4.80	- 3.40	- 2.84	0.044
PPI	1	+	+	-1.35	- 4.80	- 3.40	- 2.84	0.05
Return	1	+	+	-1.2	- 4.80	- 3.40	- 2.84	0.048

Table 5. Results of variables' correlation coefficient

No.	Hypothesis (H_0)	Correlation Coefficient	t-Statistic	Probability	Rejection or Support
1	There is relationship between consumer price index (CPI) and stock return.	-0.373	-1.06	0.0216	H_0 rejection
2	There is relationship between producer price index (PPI) and stock return.	0.417	1.21	0.0434	H_0 rejection

Table 6. Granger causality test results

1.	Delay Number	One-Year Delay		Two-Year Delay		Three-Year Delay		H_0 Support or Rejection
		F-Statistic	Prob	F-Statistic	Prob	F-Statistic	Prob	

1	There is relationship between consumer price index (CPI) and stock return.	67.09	0.01	0.007	0.93	59.09	0.145	One-year delay, H_0 rejection
2	There is relationship between producer price index (PPI) and stock return.	1.9	0.04	2.96	0.252	1.77	0.173	One-year delay, H_0 rejection